CHAPTER 7

CONCLUSION

The following conclusions can be reached based on the present investigation:

7.1 CONCLUSIONS BASED ON STIR CASTING

- From the microstructure analysis, it is seen that the particles were distributed uniformly at the processing temperatures of 750°C and 800°C. Particle agglomeration were found at the processing temperatures of 700°C, 850°C and 900°C due to the changes in the viscosity of the liquid Al matrix.

- The viscosity of the Al matrix decreases with increased processing temperatures. The suspending liquid viscosity of the Al-SiCp is higher by nearly 38% than that of the Al matrix without reinforcement.

- The tension test revealed that the ultimate strength increased gradually up to 800°C and then started to decrease gradually due to the particles distribution in the Al matrix.

- The ultimate strength decreases with increasing holding time. It is revealed that holding time influences the viscosity of the liquid metal, particles distribution and chemical reaction between the matrix and the reinforcement.

- The hardness values increase more or less linearly with increasing of holding time and processing temperatures.
7.2 CONCLUSIONS BASED ON Al/SiC

The evaluation of the interface bonding characteristics of the Al/SiC has been studied by means of the bonding process, with objectives of establishing relationship between the interface elements, interface structural morphologies and interface bonding strength.

- The structural morphologies of the interface in the Al/SiC may be altered by the presence of the interfacial elements at the interface region. The higher concentration of the Si in the matrix region near the interface alters the interface bonding characteristics of the Al/SiC.

- The higher concentrations of the Silicons at the interface were analyzed by using the EDS analysis. The interdiffusion of the Silicons was calculated by using the Arrhenius equation. The diffusion rate of Si depends on the functions of temperature and holding time. The diffusion length of silicon increased with increasing holding time.

- The segregation of the elements of Si and C increased with an increase in the processing temperature and holding time.

- The concentration of Si at the interface increases with an increase in the holding time at higher temperatures.

- The interfacial bonding strength increases with an increase in the processing temperature due to the least formation of interfacial compounds. This claim is supported by the EDS results, which show that a higher concentration of Si near the interface reduces formation of the Al₄C₃ compound and it
concentration increases with an increase in the processing temperature.

- The hardness values increases towards the interface in the matrix region due to the presence of the Silicons.

- The segregation of the elements of Si and C increased with an increase in the processing temperature and holding time.

- The concentration of Si at the interface increases with an increase in the holding time at higher temperatures.

7.3 CONCLUSIONS BASED FINITE ELEMENT ANALYSIS

From FEA analysis, the effects of the microstructure, particle distribution, volume fraction of the reinforcement and the matrix, on elastic-plastic deformation of the PRMMCs have been studied. On the basis of a two-dimensional finite element analysis of different microstructures, the following conclusions have been drawn:

- The initial plasticity, which is due to the decohesion of the interface at the matrix / particle region, decreases the load sharing capability, resulting in a decrease in the ultimate strength. In addition, the same phenomenon is observed for the particle clustering structure.

- The larger dimension of the particle is easily fractured due to the large stress concentration and high strain hardening rate around the particles and increased area of contact.

- Plastic deformation is initiated by particle fracture and interface decohesion.
• Increase in various processing temperature with holding time, thermal expansion between Al and SiC were increased. This phenomena increase thermal stress at the interface region.
• Increase in thermal stress will leads to increase thermal strain at the interface region between Al and SiC. The higher thermal strain cause interface bonding strength between Al-SiC.
• The higher thermal stresses induce more residual stress at the interface region. This may lead to create debonding between Al and SiC.